
Space Weather Technical Forecast

Issued on Thursday, 11 January 2024 at 12:06 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Ongoing likelihood of isolated M-class flares, with a slight chance of X-class flares

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate with two M-class flares. The largest an M1.9 at 10/2328 UTC from AR3538 (now rounding the northwest limb), and a M1.4 peaking at 10/1255UTC from the new region now just on the southeast limb.

There are currently twelve sunspot regions on the visible disc. AR3538 is now only partially visible as it rotates around the northwest limb, so it is no longer possible to accurately assess. AR3539 is the largest group in the northwest, and continues to show slight overall growth. In the southeast, AR3546 is showing slight weakening, and is maturing into a relatively simple configuration. Other moderate size groups, 3540/3541/3545 have all shown little overall change. A new sunspot in the northwest has gained some additional small spots but is currently a simple, small bipolar group. A further new region is rotating around the southeast limb, and given a preliminary classification, but this may change as it becomes more clearly visible. Other groups are small and magnetically simple and either stable or in decay.

A couple of CMEs were observed, including a large prominence eruption from the east limb at around 10/2030 UTC. These were modelled and do not show an Earth-directed component. A further filament eruption was observed in the northeast, beginning around 11/0500UTC, with an associated CME. This will also be assessed once updated coronagraph imagery becomes available. No other potential Earth-directed CMEs were observed.

Solar Wind / Geomagnetic Activity: Solar winds, as observed by DSCOVR and ACE at L1, were predominantly at slightly elevated speeds, varying mainly between 400 and 500 km/s. Density has been average or below throughout. Interplanetary magnetic field (IMF), Bt, was occasionally moderate through the first half of the period, peak 10nT, then mostly weak 6-8nT. The north-south component, Bz, varied between +/-7 nT. Phi angle was mostly positive (away from the Sun). Geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: GOES18 high energy (greater than 10MeV) proton flux is near background. GOES16 high energy (greater than 2MeV) electron flux was at background. The associated 24-hour fluence was well below Active throughout. The 11/0000 UTC observation was 1.28e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate solar activity is likely to continue with further isolated M-class flares, and a slight chance of isolated X-class flares.

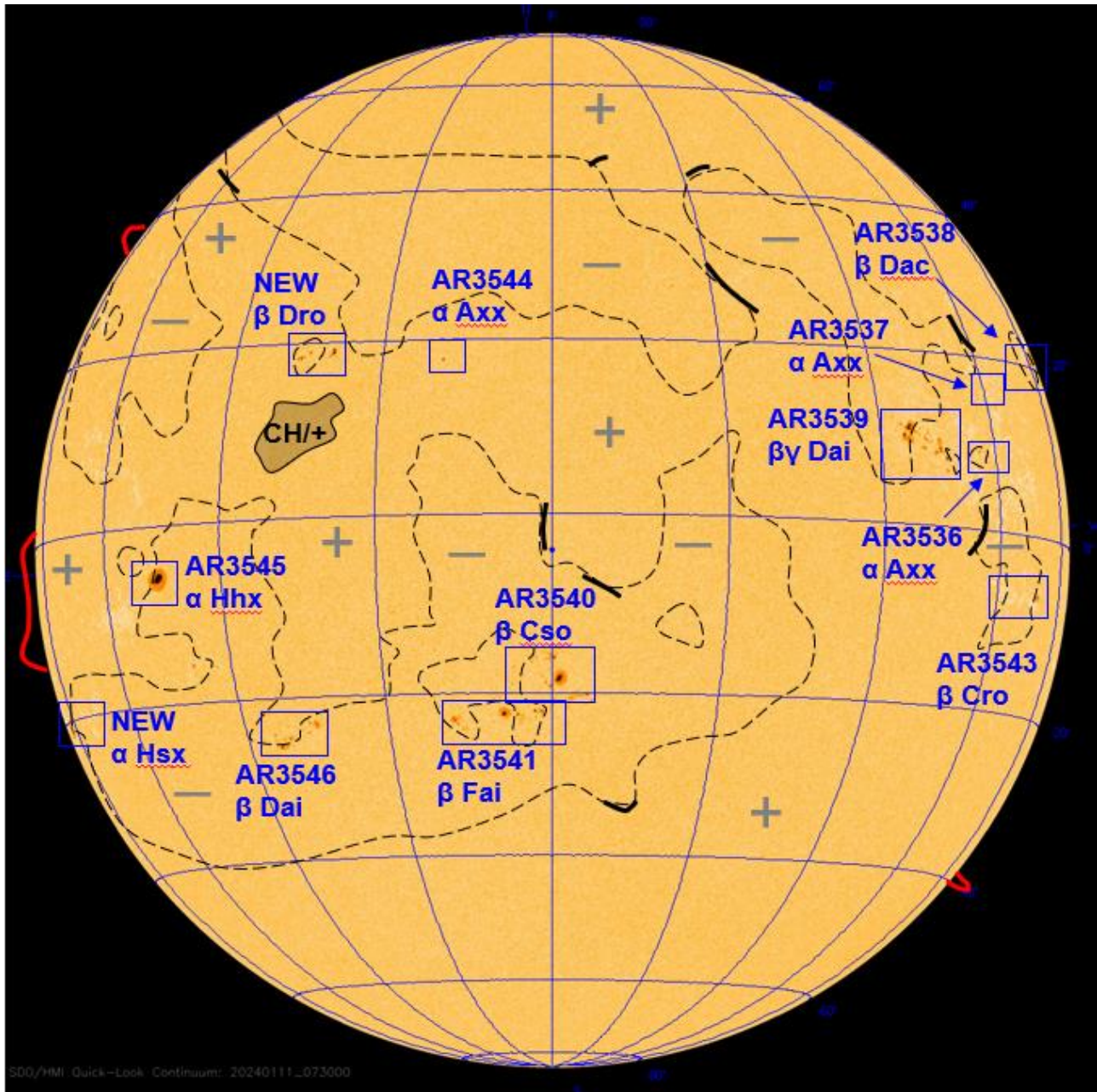
Solar Wind / Geomagnetic Activity: There is a potential glancing CME arrival. This left the Sun on 09 Jan due to a filament eruption in the southeast disc, and gives a chance of a very

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

slight glance Day 3 (13 Jan). Otherwise, slow wind conditions are expected to persist with background to slightly elevated wind speeds. Quiet geomagnetic conditions are expected for much of the period, but may rise to give a spell of Unsettled with a chance of Active with any glancing CME.

Energetic Particles / Solar Radiation: High energy proton flux is forecast to continue near background through the period, but with a slight chance of seeing further increases towards the S1 minor radiation storm threshold given any notable flaring. The high energy electron flux is forecast to persist at background, with the associated 24 hour electron fluence remaining below the Active ($1e8$) threshold.

Figure 1. Solar Analysis Valid 11/0800UTC.



Key: Filament — , Prominence — , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α - β - $\beta\gamma$ - $\beta\gamma\delta$ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

A glancing CME arrival is possible on day 3 (13 Jan), originating from a complex filament lift-off from the southeast disk on 09 Jan.

Solar wind speeds are slightly elevated and expected to persist at this or background levels throughout. This is supported by MOSWOC Enlil

Mainly Quiet geomagnetic activity is expected to persist, with only a slight chance of isolated Unsettled intervals. Any CME glance (most likely 13th) may increase activity to give a spell of Unsettled with a chance of isolated Active intervals.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	1	1	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
09/2240 UTC	Nil	SE	Filament	530 km/s	Missing	Small glance possible day 3 (13 Jan)

Radio Blackouts - X-Ray Flares:

Solar activity has been Moderate with two M-class flares. The largest an M1.9 at 10/2328 UTC from AR3538 (now rounding the northwest limb), and a M1.4 peaking at 10/1255UTC from the new region now just on the southeast limb. Further isolated M-class flares are likely, with a slight chance of an X-class flare.

There are currently twelve sunspot regions on the visible disc. AR3538 is now only partially visible as it rotates around the northwest limb, so it is no longer possible to accurately assess. AR3539 is the largest group in the northwest, and continues to show slight overall growth. In the southeast, AR3546 is showing slight weakening, and is maturing into a relatively simple configuration. Other moderate size groups, 3540/3541/3545 have all shown little overall change. A new sunspot in the northwest has gained some additional small spots but is currently a simple, small bipolar group. A further new region is rotating around the southeast limb, and given a preliminary classification, but this may change as it becomes more clearly visible. Other groups are small and magnetically simple and either stable or in decay.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	60	60	55	50
Very Active	R3 to R5 X Class	No	10	10	10	10

Solar Radiation Storms - (High Energy Protons):

GOES18 high energy (greater than 10MeV) proton flux is near background levels. Any further notable flares will bring a risk of proton flux rising again, with this risk slightly increased due to the multiple spots in the western hemisphere. This brings a slight chance of reaching the S1 Minor Radiation Storm threshold.

Please note: GOES-18 is currently being used as the primary proton instrument, with GOES-16 data currently viewed as unreliable due to a fault reported by NOAA.

Radiation Storms	Level (cm ⁻² sr ⁻¹ s ⁻¹)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	10	10	10	10
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = cm ⁻² sr ⁻¹ s ⁻¹)						

High Energy Electrons Event ($\geq 2\text{MeV}$):

High energy electron flux (greater than 2MeV) as measured by GOES-16 at GEO is currently at background, and in the absence of any significant enhancement is expected to persist at this level.

The associated 24 hour fluence is expected to remain below the Active threshold, with REFM output currently viewed as providing generally good guidance.

GEO Electron Environment	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^8$	No	1	1	1	1
Very Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^9$	No	1	1	1	1

Figure 2: Latest MOSWOC REFM output.

